

Pentium® Pro Processor Network Server Configuration Guide

Optimizing Configurations:

The Pentium Pro processor is designed to be used with a high-performance I/O architecture. Certain configurations involving programmed I/O devices can reduce the throughput of the entire I/O system, including that of bus mastering devices on the PCI bus. Pentium Pro processor systems should be configured to take full advantage of the high-bandwidth capabilities of the Pentium Pro processor bus and to reduce the effects of latency dependent non-bursting I/O devices.

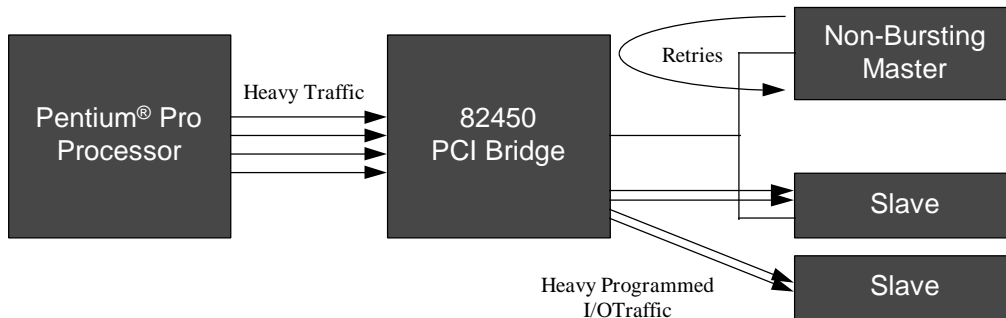
When choosing expansion cards for a system configured as a network server there are several items to consider:

- 1) Use the highest performance bus. Given a choice, choose the latest bus mastering PCI devices over EISA or ISA devices.
- 2) Avoid mixing certain PCI cards with high bus traffic EISA/ISA devices. Example: Programmed I/O ISA NICs and non-bursting PCI NICs (see below).
- 3) Use state-of-the-art PCI expansion cards. Characteristics to look for include bus mastering and burst mode PCI support. Additional buffering on the expansion card is also desirable, especially with high-speed NICs. Ideally the buffering should support one or more full packets. Two examples of bursting NIC cards for Pentium® Pro processor based systems include the 3Com 3C595 LAN adapter and the Intel EtherExpress PRO/100B adapter.

Configurations to Avoid:

Certain system configurations involving programmed I/O devices can reduce the throughput of the entire I/O system, including that of bus master devices on a PCI bus. When configured as a network server, a mix of programmed I/O and mastering devices can produce a throughput low enough to cause the loss of client connections.

In one specific example, a Pentium Pro processor system is configured as a network server using a mix of programmed I/O and non-bursting PCI masters. While running with high activity on all devices, the high speed processor(s) are capable of consuming a considerable amount of the PCI bus bandwidth in servicing the programmed I/O device(s). This is due to the high performance of the processor itself with respect to the other mastering devices. When activity levels are kept high enough, other mastering devices may be starved of bus bandwidth due to the processor's ability to stream transactions to the bus. This is observed as continuous retries to the PCI device while the programmed I/O stream is occurring.



Furthermore, the design of the Pentium Pro processor architecture favors bursting devices over slower single-transaction devices. The latency for the Pentium Pro processor bus is approximately 22 PCI clocks due to its pipelined nature. When the *starved* devices are not capable of bursting, they are not able to take full advantage of the remaining bus bandwidth as they must continuously arbitrate for bus ownership. Each time they receive ownership, they incur a 22 clock latency. Bursting devices that have gained ownership of the bus take advantage of the pipelined Pentium Pro processor bus using features such as *PCI Read Line multiple*, *PCI burst write assembly*, and *posting*.

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When configuring a system, one should always attempt to create a balance between processor performance and I/O architecture. In a Pentium® Pro processor system this means that for optimal performance, the I/O architecture should contain current, well designed, expansion cards whenever high throughput will be required to that device. For example, a server that requires two Network Interface Cards (NIC), a SCSI hard drive adapter, a modem, and a graphics card should plan to use Network Interface Cards and SCSI adapters capable of being bursting bus masters on the PCI bus. These devices in a server tend to run at high bandwidth, while the modem and video typically do not. The consequence of not configuring a server system in this way could be driver time-outs which could result in dropped clients. The benefit of configuring the system properly is superior overall system performance.

Intel is actively working with PCI expansion card vendors to help test their products in Pentium® Pro processor systems. Please contact the vendors directly for details on the operating characteristics of their products